Instructions to authors

*Quaternary Newsletter* is issued in February, June and October. Articles, reviews, notices of forthcoming meetings, news of personal and joint research projects etc. are invited and should be sent to the Editor. Closing dates for submission of copy (news, notices, reports etc.) for the relevant numbers are 1st January, 1st May and 1st September. These dates will be strictly adhered to in order to expedite publication. **Articles must be submitted at least 6 weeks before these dates in order to be reviewed and revised in time for the next issue of QN, otherwise they may appear in a subsequent issue.**

Suggested word limits are as follows: obituaries (2000 words); articles (3000 words); reports on meetings (2000 words); reports on QRA grants (500 words); reviews (1000 words); letters to the Editor (500 words); abstracts (500 words). Authors submitting work as Word documents that include figures must send separate copies of the figures in .eps or .jpg format. In case of the latter, a minimum resolution of 300 dpi is required for accurate reproduction. Quaternary Research Fund and New Researchers Award Scheme reports should limit themselves to describing the results and significance of the actual research funded by QRA grants. The suggested format for these reports is as follows: (1) background and rationale (including a summary of how the grant facilitated the research), (2) results, (3) significance, (4) acknowledgments (if applicable). The reports should not (1) detail the aims and objectives of affiliated and larger projects (e.g. PhD topics), (2) outline future research and (3) cite lengthy reference lists. No more than one figure per report is necessary. Recipients of awards who have written reports are encouraged to submit full-length articles on related or larger research projects.

**NB:** Detailed guidelines on the formatting of contributions are now available via the QRA webpage and from the editor, including an EndNote style file to help with the formatting of bibliographies for submissions to QN.


Argraff/Printed by:
Gwasg Ffrancon Press
BETHESDA
Gwynedd, North Wales
Tel: 01248 601669 Fax: 01248 602634.

All rights reserved. No part of this publication may be reprinted or reproduced or utilised in any form or by any means, now known or hereafter invented, including photocopying and recording, or in any storage system, without permission in writing from the publishers.

**COVER PHOTOGRAPH**
Prominent cross-valley ridges in the Sittaford valley, Dartmoor: Evidence of glaciation? See the report by Bendle in this issue for more details (caption: Sven Lukas; photo: Dave Evans).
OBITUARY

JOCELYN MARY RILEY (NÉE LETZER) (1943-2014)

Jocelyn Letzer was an active member of the Quaternary Research Association in the 1970s, being involved in and attending field meetings, and it is with great sadness that I have to report her death on 30th August 2014.

Jocelyn was a part-time research student at Birkbeck College studying the glacial geomorphology of the southern part of the Vale of Eden and adjacent hills, and who was awarded an MPhil from the University of London in 1978 (Letzer, 1978). This research degree followed from an undergraduate degree in Geography at Birkbeck College University of London, where she studied for three evenings a week over a four year period while carrying out a full-time teaching job during the day. At the time, this was a regular pathway towards a degree for those who had gone into teaching via a Teacher’s Training College.

Jocelyn’s thesis was a very fine piece of work, an opinion I find supported by a note from Geoffrey Boulton who had borrowed the thesis, and describes it as ‘an excellent piece of work’. The work involved extensive, very detailed field mapping and spatial investigation of the mapped data using trend surface analysis. This work confirmed similar findings from the Glasgow area, and it was Jocelyn’s drive that lead to the publication, in the *Journal of Glaciology*, of a paper entitled ‘Superimposed Drumlins’ which introduced the concept of glacier bedforms (Rose and Letzer, 1977), a subject that is now a key part of glacial geomorphology/glaciology and has been taken to its present status through the work of Geoffrey Boulton and Chris Clark, amongst others.

While carrying out the fieldwork for this research Jocelyn walked across and mapped an area that was farmed by one Alan Riley. Clearly she had to ask permission to access the land, and so she had to meet the farmer. The rest is history. After marriage, Jocelyn and Alan moved to a National Trust farm in Grasmere in the Lake District where they brought up three children and which Alan continues to farm.

As a Cumbrian farmer’s wife Jocelyn learned the skills of farming and acquired a wonderful Cumbria accent (quite different from that of Edgware, London where she was brought up). She continued her interest in Quaternary Science, attending and leading field trips in the area and producing an occasional publication. Perhaps
more importantly, in addition to working on the farm, she used her skills to teach
glacial geomorphology and farming for the Lake District National Park, the Field
Studies Council and for adult education. Reputation has it that she was very good
at coming up with innovative and original ideas for teaching, something I can
well believe. Jocelyn is survived by Alan and their three children.

Jocelyn’s memory is retained by the dedication to her of a paper by Mike Smith,
Saskia Keesstra and myself in GeoResJ on ‘Use of legacy data in geomorphological
research’ (Smith et al., 2015), very appropriate in view of her contribution to
Quaternary Science.

References and Bibliography.

Letzer, J.M. (1978). The glacial geomorphology of the region bounded by Shap
Fells, Stainmore and the Howgill Fells in East Cumbria. Unpublished University
of London MPhil degree, 339 pp.

Great Britain and Ireland, Balkema, Rotterdam, 323-334.

Mitchell, W.A., Riley, J.M. (2006). Drumlin map of the Western Pennines and

Rose, J., Letzer, J.M. (1975). Drumlin measurements: a test of the reliability of
data derived from 1:25,000 scale topographic maps. Geological Magazine, 112,
361-371.

18, 471-480.


Jim Rose
Department of Geography
Royal Holloway, University of London
Egham, Surrey
TW20 0EX

Visiting Research Associate, British Geological Survey
Keyworth, Nottingham, NG12 5GG

Jimrose@clara.co.uk
A NOTE ON JOHN GOUGH, 1757 – 1825: A PIONEER SCIENTIST OF LAKE AND BOG DEVELOPMENT

Keith E. Barber

In June 1790 John Gough of Kendal, in the old county of Westmorland, wrote an essay on “Reasons for supposing that LAKES have been more numerous than they are at present; with an Attempt to assign the Causes whereby they have been defaced”. It was published in the 1793 edition of the Memoirs of the Literary and Philosophical Society of Manchester, the first and oldest ‘Lit & Phil’ in the World, and the second oldest Learned Society in the United Kingdom (see www.manlitphil.ac.uk/).

The purpose of this note is to bring to the wider Quaternary community the pioneering nature of Gough’s observations and theorising, which are all the more remarkable given that he had been blind from the age of two – he is the Blind Philosopher of Wordsworth’s epic poem The Excursion (book 7, lines 482 – 515). Gough’s other achievements and his friendships with notable scientists and artists of his time, including John Dalton and William Wordsworth, are detailed in the Dictionary of National Biography http://www.oxforddnb.com/view/article/11139?docPos=7.

With his 1790 essay Gough may be regarded as the first person to clearly lay out the way in which lakes are infilled by vegetation and ‘terrestrialised’ into fens and peat bogs, the process often referred to using the German term Verlandung, though I have been unable to trace any reference to this in the German literature until much later than Gough’s observations (e.g. Weber 1902 and 2002).

He begins by noting the processes of decomposition of plants in water, that “…all its mucilage and gum will soon be extracted; but the resin, the woody fibre and the cellular substance of the pith are not soluble …” He goes on
to describe how “… a pool, will, in process of time, be occupied by solid matter, which will consist of the remains of its own produce gradually accumulated and preserved by the water … which protects them from decay.” And later “… the margin of the pond will be progressively advanced, and its surface contracted in proportion …. Lastly, the solid plain, thus produced, will, in time, be covered with a bed of vegetable earth.”

Gough goes on to make a number of observations on the consequences of this principle, mentioning that it ‘account(s) for the production of those flat marshes that supply many countries in the north of Europe with fuel’, and that ‘in every bog there is a quantity of water always ready to occupy any depression ….in fact, humidity is so necessary to the preservation of this kind of earth …’.

Gough was not the first person to make some of these observations – both Boate (1652) and King (1685), reviewed by Gorham (1953), wrote about the bogs and loughs of Ireland but ascribed the formation of bogs mainly to springs and the inundation of low-lying mineral soil, what we would now term paludification, and did not comment on terrestrialisation of lakes. This is not perhaps surprising since many Irish peatlands have paludified their surroundings, and given the prevalence of blanket peats in Ireland.

Gorham’s (1953) review is a valuable source of such early ideas on peat lands though he was mistaken in that he ascribed the first descriptions of terrestrialisation to De Luc (1810) and in particular to Aiton (1811), though the former believed that the succession ended with hay meadow or pasture whereas Aiton describes the final stage as raised bog. Aiton also described the hummock-hollow complex of raised bogs some decades before Scandinavian researchers (Barber, 1981: 6-7). Although Gough’s work does not include the species detail that was recorded by Aiton it is clear that he was the first to elucidate the principle of terrestrialisation some 20 years earlier.

Gough also recognises that the depth and morphometry of lakes will influence their development into peatlands and that Schwingmoor or quaking bogs exist – “…dangerous pits, which are more or less concealed by a thin crust formed by aquatic plants …’. In discussing the uses of peat Gough clearly recognises what we now term autochthonous - in situ - and allochthonous – washed or blown in - components of peat; he describes their arrangements as strata, and comments on how, for example, the direction of the prevailing wind may be deduced from the presence of preserved fallen trees. He also has perceptive comments on the native status of yew, commonly found fossil in bogs, ‘…because the abundance … concealed in our marshes proves that they were formed when the land was over-run with wood’ – an early recognition of the original vegetation of Britain ‘… before agriculture and the art of planting were known to her inhabitants.’ Gough also notes that the original treelines of Britain may be found from searching out
woody macrofossils in peat deposits at varying heights in the mountains, and he distinguishes blanket peat from other forms of deposit.

In the last part of the essay, some eight pages, Gough describes weathering and the formation of regolith before going on to make observations on the capacity for water to erode and transport sediments. He notes the differences between soft and hard rocks in this regard and how during heavy rains the small mountain rills are transformed into ‘furious torrents that carry all before them … the loose stony bottoms are swept away, and driven to the lower ground, leaving a new surface of the rock exposed to the atmosphere, which in time is broken up by its action …’ He goes on to describe the deposition of sediments as stream velocity falls ‘… the largest first, and the less in succession, according to their bulks and comparative weights.’ This recognition leads on to a succinct description of the cycle of erosion – ‘Hence it appears, that the lower parts of the channel are continually rising from the accretion of fresh materials; and the upper end is gradually depressed by the removal of the same, till the whole becomes a gentle declivity, down which the current will glide …’ and he also comments on the ability of vegetation to stabilise the beds of rivers.

Gough was of course writing 47 years before Louis Agassiz propounded his coherent theory of a worldwide ice age with extensive glaciers and ice sheets in temperate latitudes. This accounts for his difficulty in explaining the presence of ‘… coves which seem scooped out of the sides of several hills …’ that is, cirques or corries. He recognises these as ‘… perhaps the most singular objects of the kind’ and while he has no real explanation of their origin he nevertheless describes their features accurately:-

The entrance into one of these places always lies through a narrow pass, between two steep banks. A rivulet commonly flows through this opening, which, in some cases conveys away the superfluous water of a basin [sic] lying in the centre of the natural amphitheatre.

He goes on to describe ridges of pebbles and small hills of sand and pebbles ‘… many yards above the limits of the greatest floods and … they consist wholly of rolled stones, arranged in strata with beds of sand between them.’ He also notes that they contain no shells and so rules out a marine origin – how close he came to realising that they could have a glacial origin!

Gough was a truly remarkable man who wrote on a variety of scientific subjects, such as the propagation of sound – of obvious interest to a blind man – the germination of seeds, the nature of atmospheric gasses, as well as other aspects of natural history. He was fluent in Latin, Greek and French and acted as a private tutor in mathematics to many local men who went on to university and distinguished careers. He deserves recognition as a pioneer in the development of ideas in Quaternary science.
Postscript

In the course of reading around this topic I came across the following from *The natural and agricultural history of Peat-Moss or Turf-Bog* by Andrew Steele (1826):-

There is also recorded in the Phil. Trans. in 1734, vol. xxxiii. No. 4434., an account by Dr Balguy to the Royal Society, of the bodies of a man and woman found in a peat-moss in Derbyshire. They had been lost on a peat-moss in a great fall of snow, 14th January 1674, and when found, were buried on the spot by order of the Coroner. The man's name was Barber; he had been a considerable grazier but being reduced in his circumstances, was then going off with his servant-maid for Ireland. They lay where they were buried,

As one who has devoted his scientific life to the study of peat bogs this was a peculiar shock!

Acknowledgements

I am most grateful to three of my mentors in the early stages of my peaty researches. Professor Donald Walker’s 1961 papers on Irish peat stratigraphy were the inspiration for my PhD research conducted at Lancaster University under the supervision of Professors Frank Oldfield and the late Gordon Manley. It was the latter who apprised Donald Walker of the existence of Gough’s 1793 paper, and Donald passed this and other papers to me at the suggestion of Frank Oldfield. I hope that I have done some justice to Gough’s astonishing achievements. I am also grateful to Carol Davies, Curator of Kendal Museum, for the photograph of Gough’s bust, which is held by the museum.

References


Gough, J. (1793). Reasons for supposing that LAKES have been more numerous than they are at present; with an Attempt to assign the Causes whereby they have


Keith E. Barber  
*Palaeoenvironmental Laboratory University of Southampton (PLUS)  
Geography and Environment  
University of Southampton  
Southampton SO17 1BJ  
Keith.Barber@soton.ac.uk*
The 19th Annual International Postgraduate Symposium was hosted by the Department of Geography at the University of Exeter from the 27th to 29th August 2014. The meeting was organised primarily by Nicole Sanderson with help from her team of Exeter postgraduate students: Jamie Johnson, Lilo Henke and Holly East. It was attended by 20 students from 15 universities across Europe. With 6 themed sessions, 14 talks and 5 posters, the symposium demonstrated the ongoing relevance and ever-evolving focus of Quaternary Science in a changing world. With topics ranging from Australian coral reef development to river evolution in the Amazon, we experienced the diversity of Quaternary research. The two and half action-packed days also included a fieldtrip to Dartmoor, a tour of Exeter’s PalaeoFire Lab and a plentiful serving of good Devon food.

The Symposium kicked off on the 27th August with the fieldtrip to Dartmoor, led by the charismatic and knowledgeable Dr Tim Harrod, recipient of the 2014 Dartmoor Society Award. From 1965 until 1987, Tim worked with the Soil Survey of England and Wales until it was disbanded. Upon retirement in 2001, he voluntarily took up the challenge of completing the unfinished Soil Survey work in Devon, single-handedly mapping 50,000 acres of ground. His expertise throughout the trip on the area’s archaeology, geology and geomorphology made up for the drizzle and mist as we toured around sites including stone circles, granite quarries, solifluction deposits and an exposure of a buried tor. He also provided an insight into the differing perspectives surrounding the current Dartmoor glaciation debate (further discussed during the 2014 GLWG-QRA fieldtrip to Dartmoor).

A particular highlight of the trip was the visit to Grimsound, a late Bronze Age settlement (c. 450 – 700 yr BP) with 24 hut circles surrounded by a boundary wall. Also visible from this site are tin workings of various ages and medieval cultivation lynchets. We then retreated from the rain into the Warren House Inn, a remote pub in the heart of Dartmoor where the fire has supposedly been burning since 1845. The weather cleared up for the afternoon allowing us to recover and examine some short peat cores from Holming Beam, and to climb Little Staple Tor for some spectacular views. Following the fieldtrip, we returned to Exeter for a drinks reception in the University’s Holland Hall with some cloudy views of the surrounding Devon countryside. We then headed into the city centre to The Old Firehouse, which is an Exeter institution with a vast array of local ciders and huge pizzas (it’s also the inspiration for the Leaky Cauldron in Harry Potter!).
The second day included oral presentations across four themed sessions: multi-proxy reconstructions, tephrochronology, landscape change in the Amazon, and glaciology, which were each accompanied by lively discussion time. Exeter’s Prof. Dan Charman gave a useful talk on post-PhD career progression and the ensuing discussion was continued over a much appreciated Devon cream tea! The poster session gave another means for delegates to present their research and engage in further valuable discussion time. This was held at the top one of the tallest buildings on campus giving sunny views out over the Exe Estuary. We were also treated to a tour of Exeter’s new PalaeoFire Lab, the world’s first specifically designed PalaeoFire laboratory. The main aim of the research undertaken in the Lab is to understand the role of fire in shaping our ecosystems and to quantify the feedbacks that wildfires have had to Earth system processes. Dr Mark Grosvenor gave a demonstration (involving plenty of flames!) as to how the equipment can be used to assess the flammability of natural fuels. In the evening, the conference dinner was held near the quayside at The Hourglass, which provided the opportunity for everyone to relax and socialise over great local food.

The third and final day saw a further two oral presentation sessions: sea-level change and ocean circulation; and coral reefs. The symposium then closed with the Annual General Meeting, which included the presentation of the symposium awards and crucial decisions regarding the year ahead. Prizes were awarded to Holly East (University of Exeter) for her oral presentation ‘The development and
evolution of coral reef rim islands, Maldives Archipelago’; Elizabeth Watson (University of Leeds) for her poster ‘Is one core enough? Tephra variability within a Holocene peatland’; and Chris Darvill (Durham University) for the best Quaternary-themed photograph. Cambridge, headed by Jenny Roberts, won the bid to host the 2015 Annual International Postgraduate Symposium. Jack Lacey (University of Nottingham) was elected as the new QRA Postgraduate Representative alongside existing representative Chris Darvill (Durham University), whilst Julia McCarroll (University of Gloucester) stepped down from the two year position.

On behalf of all the postgraduate members and the QRA, we thank Julia for her work as rep, and Nicole and the Exeter team for organising a fantastic symposium this year. In addition, thanks go to all of the delegates for their attendance and enthusiasm – we look forward to seeing you in Cambridge.

Figure 2. Delegates of the QRA Postgraduate symposium

Holly East
Department of Geography
University of Exeter
Amory Building
Rennes Drive
Exeter
EX4 4RJ
hke201@exeter.ac.uk
Introduction

This year the Glacial Landsystems Working Group (GLWG) met on the granite uplands of Dartmoor, an area traditionally regarded as a relict periglacial and permafrost landscape that developed over the entire Quaternary period, and outside the limits of Pleistocene glaciation (e.g. Linton, 1949; Waters, 1964).

In the first of what will likely be many joint GLWG/QRA field meetings, the 15th GLWG meeting aimed to challenge this longstanding view, examining landform and sedimentary evidence for the existence of plateau ice on the moor, probably related to the last glaciation (cf. Evans et al., 2012). The trip, led by Dave Evans (Durham University) and Stephan Harrison (Exeter University), stimulated three days of energetic, informal discussion amongst the 40 or so participants that comprised a varied mix of seasoned GLWGers, first-time GLWG attendees and amateur enthusiasts.

Figure 1. GLWG 15 participants at South Sittaford Tor valley (photo: Dave Evans)

Thursday 23rd October

On Thursday 23rd October the GLWG participants gathered at the Dartmoor Expedition Centre in Widecombe-in-the-Moor. Informative talks in the church/village hall from Dave Evans and Stephan Harrison provided details on the site locations, geology and the landform-sediment assemblages that would be examined over the coming 2.5 field days, before the group collectively retired to the local ale house.
Friday 24th October

Site 1: Lower reaches of the Okement River valley

After the previous evening’s talks the GLWG party first travelled to the lower reaches of the West Okement River valley in northwest Dartmoor (SX563918). After a short walk, the group observed perhaps the best example of an overdeepened U-shaped valley in northern Dartmoor, now occupied by the Meldon Reservoir. Discussion arose regarding the valley’s formation, with Stephan Harrison arguing that the U-shaped profile was difficult to reconcile with periglacial processes alone, with Ian Evans suggesting that the melting of cold-based plateau ice, and the resultant glaciofluvial activity, may have helped oversteepen the valley sides. Simon Carr also suggested that the steep-sided profile might have resulted from multiple phases of glacier occupation.

After a short, 2–3 km amble up-valley (SX555904), the group observed further evidence of possible glaciofluvial activity, in the form of a flat outwash plain strewn with boulder accumulations. At this point, the first shower of GLWG 15 started to fall, in what would end up being a particularly drizzly day.

Site 2: Corn Ridge

Following a short climb over Shelstone Tor, the party stopped to examine an amphitheatre-like hollow cut into the north-facing edge of Corn Ridge plateau (SX555897). Ian Evans described the hollow as a weakly-developed, incipient cirque of north-easterly aspect, not dissimilar to cirques in Wales that are thought to have been occupied by small Younger Dryas-aged glaciers.

Through a thickening mist Dave Evans drew attention to the approximate limit of downslope drift infill (with possible latero-frontal moraine ridges) and several elongate debris ridges with the appearance of flutings. This led to discussion about the style of former glacier occupation. The fluting forms were suggested to reflect subglacial streamlining and thus evidence for expanding plateau ice flowing northward over the Corn Ridge plateau, maybe to capture and supersede a previously more restricted niche glacier. Dave Evans cited the Þórisjökull icefield as a potential modern analogue for this situation.

To conclude investigations at Corn Ridge, the group explored stream sections through subdued drift hummocks that revealed consolidated clast-rich diamictons containing sub-rounded and sub-angular clasts. While Dave Evans argued for a glacial origin, others in the group suggested a non-glacial slope origin.

Site 3: Corn Ridge Tor

Following a brief, and altogether soggy lunch-stop, Dave Evans successfully steered the group through a thick mist to Corn Ridge Tor (SX551891). Here it was
argued that the subdued morphology of the ‘Type 2’-category tor (cf. Evans et al., 2012), alongside the general absence of clutter – a local term for the irregular spreads of coarse, angular debris around many summit tors in Dartmoor – provide evidence for its former coverage under plateau ice. Discussion then arose over the potential for cosmogenic nuclide exposure dating of supposed ice-covered tors, in light of a recent paper by Gunnell et al. (2013), with Tim Barrows pointing out the likely problems of inheritance and unknown tor weathering rates.

**Site 4: The Slipper Stones**

The first day concluded with a steep descent down the bedrock cliff at the margin of the Corn Ridge plateau into the amphitheatre-like hollow of The Slipper Stones (SX563887). Here, Stephan Harrison argued for the existence of a small palaeoglaciers, pointing out abraded granite slabs on the backwall and subdued roche moutonnee forms. John Hiemstra and others suggested a structural, rather than glacial, control of the formation of the roche mouttonee-like forms. However, in timely fashion, the skies cleared to reveal several boulder-strewn ridges of clear lobate form, and discussion began about whether the ridges were ice-marginal, or the product of rock slope failure(s), with the majority supporting a glacial origin. As such, the group concluded that The Slipper Stones provided perhaps the most convincing landform evidence of niche glaciation in northern Dartmoor.

**Saturday 25th October**

**Site 1: South Sittaford Tor valley**

On Saturday morning GLWG members awoke to brighter skies. Following a brief talk on aspects of Dartmoor’s geology from Tim Harrod, the group walked the 3-4 kilometres from Dartmoor National Park Visitors Centre to south Sittaford Tor valley (SX638813). Here the group could observe a variety of landform assemblages, including dry valley-side channels, drift benches, valley floor hummocky drift and, in particular, a prominent cross-valley moraine ridge at the mouth of the valley.

Sections through the proximal end of the moraine showed highly weathered, or ‘rotten’, granite (growan), overlain by a sequence of gravelly diamicton, stratified sand and gravel and finally, a clast-supported diamicton with contorted bedding and shallow angle faults. Sections through the distal end of the moraine revealed stratified (and in places contorted) sand and gravel lithofacies, typical of glaciofluvial and debris-flow sedimentation. Dave Evans argued for ice-contact fan deposition at the margin of a glacier lobe, with the contorted bedding providing evidence for glacier snout advance over the moraine. Similar models have been proposed for moraines emplaced by Scottish Younger Dryas glaciers (Lukas, 2005). The group then pondered the likely geometry of the former ice-
mass occupying the valley, with one model hypothesising moraine formation in
the suture zone between confluent ice lobes emanating from South Sittaford Tor
valley and Winney’s Down Brook. The upvalley hummocky drift was considered
indicative of staggered ice recession toward the plateau-ice dispersal centre.

Site 2: Two Bridges Quarry

After a relaxed lunch outside the Dartmoor National Park Visitors Centre the party
reconvened at Two Bridges quarry, the first site in an afternoon spent examining
permafrost and periglacial landforms. Dave Evans provided an overview of the
historical context of the quarry in Linton’s theory of tor formation (Linton, 1955)
and Julian Murton described the section, pointing out in situ granite blocks
(‘corestones’) surrounded by ‘decomposed’ granite (growan), as well as jointing
patterns characteristic of ice-lenses and permafrost activity.

Site 3: Great Mis Tor and Cox Tor

The rest of the afternoon was spent around Great Mis Tor (SX562769) and Cox
Tor (SX530761) to illustrate landforms typical of periglaciation. After a sharp
climb up to Great Mis Tor Dave Evans first alluded to the striking difference
between the ‘Type 1’ castellated Great Mis Tor, which comprises corestone stacks
with cantilevered blocks and deep tor jointing, and the subdued ‘Type 2’ tors of
the Corn Ridge plateau viewed the previous day.

Discussion amongst the group then focused on the extensive (>300m in
length) clitter slopes immediately west of Great Mis Tor. The clitter fields are
traditionally assumed to reflect the downslope solifluction of frost shattered
debris. However, Stephan Harrison posed an alternative model of permafrost
creep moving gelifracted tor material downslope. This model is consistent with
clast macrofabrics taken from the ridges and hollows of 4 distinct clitter slope
terraces (Harrison et al., 1996), the overall thickness of the boulder accumulation,
and the dominance of coarse material (i.e. no fine-grained matrix as is common
in solufluction deposits). The group were generally in acceptance of this model
but also entertained other hypotheses, such as the possibility of an underlying
structural control on the formation of clitter slope terraces.

After a brief stop for ice creams, the party climbed a series of well-defined
altiplanation terraces to reach the day’s final site at the summit of Cox Tor. Here,
Dave Evans discussed the likely genesis of distinctive earth hummocks that occur
around Cox Tor. The hummocks are late Holocene in age but are considered to
have formed under cold but humid climatic conditions as a result of frost action.
To conclude the day, GLWG participants were asked to ‘pin their colours to the
mast’ and vote on whether they believed Dartmoor to have been glaciated during
the Quaternary, with the vast majority seemingly convinced by the landform-
sediment evidence witnessed over the course of 2 days.
**Sunday 26\textsuperscript{th} October**

*Site 1: Great Varracombe and the North Teign River*

With GLWG members in high spirits, the final day of GLWG 15 offered a visit to Great Varracombe in the North Teign catchment (SX639845) to observe a variety of landform-sediment assemblages that support the south-eastward flow of ice from the Hangingstone Hill plateau (cf. Evans \textit{et al.}, 2012). Here, Dave Evans drew the group’s attention to a series of 5 deeply-incised dry channels cut into the Quintin’s Man bedrock interfluve, and a sinuous bouldery ridge that extends from the northernmost channel. The group discussed mechanisms for the formation of the channels. One suggestion was that the channels were excavated through periglacial processes in zones of altered bedrock; however, Dave Evans argued that the sinuous bouldery ridge provided evidence for the existence of a subglacial meltwater system; the ridge thus representing an esker. Dave went on to suggest that the location of the esker would probably mark the position of a suture zone between two ice flow units flowing from west to east, thus providing evidence for extensive plateau ice. Finally, to provide further evidence for the presence of glacier ice in Great Varracombe, Dave Evans recovered sub-rounded facetted clasts from a stream section around 30m east of the sinuous ridge.

The meeting was then called to a close, with several of the more senior QRA members reflecting on the fact that this meeting had been characterised by a marvellous atmosphere, in the style of the “good old fashioned QRA field meetings!”.

John Heimstra volunteered to run next year’s GLWG meeting in South Wales, and the group thanked Dave and Stephan for an excellent and thought-provoking 3 days.

**Figure 2.** Stephan Harrison discusses the formation of clutter slopes at Great Mis Tor alley (photo: Dave Evans).
Acknowledgements

Special thanks are due to Dave Evans and Stephan Harrison for their excellent presentation and explanation throughout. Thanks are also due to the Dartmoor Expedition Centre for their hospitality. Finally, thanks are due to those who provided their vehicles to offer transport between sites.

References


Figure 3. Dave Evans presents a hypothesis for the south-eastward flow of confluent plateau ice lobes in Great Varracombe and muses over the glacial origin of the boulder on which he stands (photo: Dave Roberts).


Jacob Bendle
Centre for Quaternary Research
Department of Geography
Royal Holloway, University of London
Egham, TW20 0EX
Jacob.Bendle.2011@live.rhul.ac.uk
NEW RESEARCHERS AWARD SCHEME

INCREASING FRESHWATER RUNOFF AND TIDAL ACTION INFLUENCES ON SPATIAL MIXING PATTERNS IN SØNDRE STRØMFJORD, WEST GREENLAND

Background and Rationale

Greenland Ice Sheet melt has the potential to affect global sea levels and the strength of the thermohaline circulation (THC). Although multiple temperature proxies have been developed, means of reconstructing runoff from ice sheets and glaciers remain problematic. Freshwater influx into the North Atlantic is one of the major components that govern the strength of the THC. It has been proposed that a major influx of freshwater associated decay of the Greenland Ice sheet (GrIS) could lead to permanent reduction in the North Atlantic surface salinity, hence causing a change in global ocean circulation with severe implications for northern hemisphere climate. Investigating spatial mixing patterns of seawater in Greenlandic fjords can help reveal characteristics of changes in runoff from the GrIS; for example higher runoff may be associated with lower salinity within GrIS fjords, which can be recorded by palaeoenvironmental proxies (Kamenos et al. 2012). The New Researchers Award enabled me to reveal these characteristics of runoff by aiding in laboratory analyses of water samples collected, revealing oxygen and deuterium isotope patterns within Søndre Strømfjord.

Results

Salinity and Temperature profiles were obtained at 11 stations along Søndre Strømfjord (a 180km fjord) during the 2014 melt season. Each station was sampled twice once at high Kangerlussuaq Drainage Basin (KDB) runoff and once at low KDB runoff over a 7 hour time period. In-situ salinity and temperature profiles were measured using an Idronaut 304 oceans7 CTD probe to 40m depth. Data was recorded continuously at 8Hz (125 milliseconds) and the probe was lowered at a speed of 1.0ms⁻¹. Only data from the up-casts were used. Water samples were collected at a depth of 10m and stored in borosilicate glass exetainers for δ¹⁸O and δD analyses. At this depth δ¹⁸O, and δD, are taken up by red coralline algae (Lithothamion glaciale), a proxy to reconstruct Holocene climate variability.

Temperature and salinity data from the 2014 cruise (Figure 1) are represented as a contour plot. Each station is separated by 10km along 112km of the 180km fjord. Data shows that with increasing freshwater runoff, salinity decreases by
Figure 1: Transverse section of salinity and temperature along Søndre Strømfjord during Low and high runoff. Salinity characteristics are shown in (a) low runoff and (b) high runoff. Temperature characteristics are shown in (c) low runoff and (d) high runoff. Note direction of the plot is north-east to south-west and profiles start 12 km from the GrIS runoff source (Watson River). Small black vertical lines indicate location of profiles and bathymetry data is based on profile depth.

1.65 – 2.91 at each station. Higher salinities occur at low run-off. In addition, with increasing run-off, the disparity between surface and deeper water (30m) becomes greater with a 19.3 salinity difference between the surface and 30m, temperature increases by 0.47°C – 2.34°C.

This information was integrated with oxygen and deuterium isotopic signatures, collected at 10m depth, from each station to pinpoint the exact source of the runoff causing salinity reductions. Isotope patterns indicate a general enrichment of values, δ¹⁸O enriches between 0.94- 2.37 permil and δD enriches between 5.72- 42.30 permil, away from the main KDB freshwater source (Watson river) excluding a 30 km stretch between stations 6 (50km) and 9 (80km) were both δ¹⁸O and δD significantly deplete in the heavier isotope.

With increasing freshwater runoff, the chemistry of the fjord exhibits an enrichment of the heavier isotope except between stations 6 and 9 where low runoff values are enriched compared to high runoff values. δ¹⁸O values enrich by 7.40 permil while δD enrich 53.26 permil. Between stations 6 and 9 values deplete by 2.06-
6.34 permil $\delta^{18}$O and 5.60-32.57 permil $\delta$D. Stations 6-9 (50-80km) are further affected by the addition of freshwater from the Sukkertoppen Ice Cap, resulting in these depleted values.

**Significance**

Our data show a relationship between KDB runoff and salinity of Søndre Strømfjord, data that will enable further calibration of marine proxies of GrIS melt. Understanding how $\delta^{18}$O, $\delta$D, and oceanographic variables change with increasing freshwater and mixing will allow for detail reconstruction of seasonal climate variability over the recent Holocene and reveal characteristics of changes in runoff from the GrIS. Knowledge gained, combined with our proxy of interest, will advance reconstructions of runoff from Ice sheets, glaciers and calibrations of marine proxies against instrumental records.

**Acknowledgments**

I would like to thank the Quaternary Research Association for their support in funding laboratory analyses of water samples with the New Research Workers Award. I greatly appreciate Dr. Finlo Cottier and John Beaton at the Scottish Association for Marine Science (SAMS) for the use of their Idronaut 304 oceans 7 CTD; without their help valuable information could not have been obtained. I would also like to thank Terry Donnelly and Julie Dougans at the Scottish Environmental Research Centre (SUERC) for their technical support in laboratory analyses of samples. Field work and the 2014 cruise was made possible with the help and hard work of captain Jørgen Andersen at Entreprenør Services and Dr. Nick Kamenos.

**References**


Crystal R. Smiley  
Nick A. Kamenos  
Trevor B. Hoey  

University of Glasgow  
Glasgow, G12 8QQ  
United Kingdom  
C.Smiley.1@research.gla.ac.uk  
Nick.Kamenos@glasgow.ac.uk  
Trevor.Hoey@glasgow.ac.uk
THE PLEISTOCENE SEDIMENTS AT SAVOCK QUARRY, BUCHAN, NE SCOTLAND

Background and rationale

The Pleistocene sediments exposed at Savock quarry (NGR NK 065 424), 7 km SW of Peterhead in Buchan NE Scotland (Figure 1), were brought to my attention by Professor Adrian Hall. They are of significance for investigation as a number of other sites in the immediate area record evidence of palaeoenvironments dating back to MIS 8? (Merritt et al., 2003). The grant from the QRA Quaternary Research Fund was used to travel to the site and log and sample the available faces in the quarry in an attempt to place the sequence within the complex local stratigraphy.

Results

Sections in the SW, S and E faces of the quarry were exposed when the site was visited though they were locally inaccessible. The stratigraphy recorded, primarily in the SW and S faces, was composed of the following units (base upwards). Lithofacies codes used are from Benn and Evans (2010):

1) locally weathered igneous and metamorphic bedrock

2) channel-form cut into the weathered bedrock. Approximately 220 m wide with an estimated depth of 5 m. The channel is most clearly seen in the S face and the fill thins to both the E and W. It is not present in the poorly exposed W and E faces of the quarry and the N face is totally obscured by dumped material.

3) the fill of the channel-form is composed of a fining-upward sequence of pebbly sands (with occaisional cobbles and boulders) to sands. Up to 5 m thick. It was not possible to access this unit for detailed descriptions and sampling due to its height in the quarry face.

4) Lower diamicton (Dmm). 1.75 m thick. 2.5Y 4/2 (dark greyish brown with subtle colour banding), sandy texture, very few large pebble-cobble sized clasts of flint and quartzite. Sharp lower boundary on channel-fill sediments. A single clast fabric was measured in this unit in the SW face and shows a well developed WNW-ESE prefered orientation.

5) Upper diamicton (Dmm). 1.65 m thick. 5Y 5/1 (grey), sandy texture, upper half of the unit has conspicuous numbers of cobble-sized clasts of well rounded flint and quartzite. Lower boundary on underlying diamicton is sharp, but...
apparently conformable, and marked by a cm thick yellowish brown sand lamina. There are conspicuous vertically oriented clasts in the upper part of the unit. The modern soil profile is developed in this bed. Clast fabrics were measured in the lower half of the unit at two sites (SW and E faces) and both showed well developed WSW-ENE preferred orientations.

Unfortunately at the time of the visit it was not possible to access the channel-fill gravels and sands (unit 3 above) to collect samples for lithological analyses or for optically stimulated luminescence (OSL) dating. The site is being monitored and it is hoped to sample these sediments on future visits. The likely N-S orientation of the channel mirrors the orientation of the Dens channels to the immediate E of the quarry. This major channel system (either marginal or subglacial) was cut prior to the Late Devensian glaciation of the area and it may be that the channel-fill sediments themselves date to a pre-Late Devensian event.

Clast fabric measurements contained clast lithologies (particularly the well rounded flint and quartzite clasts derived from the Buchan Gravels Formation (Tertiary) to the immediate SW of the site) and texture indicate that the Upper Diamicton (unit 5) is a till and part of the East Grampian Glacigenic Subgroup (Figure 1) deposited by the Late Devensian ice sheet as it advanced ENE across the site. Correlative tills are present at nearby sites (Oldmill, Toddlehills, Kirkhill/Leys, Sandsford Bay. Figure 1) where they are known to overlie older Devensian sediments or last interglacial palaeosols (Merritt et al., 2003; Gemmell et al., 2006).

Correlation of the Lower Diamicton (unit 4) is less certain. Tills deposited by ice sheets flowing from the NW across central Buchan are known from at least two cold stages. An earlier event (probably MIS 6) is recorded by tills at Toddlehills (Gemmell et al., 2006), and tills beneath last interglacial palaeosols at Kirkhill and Leys quarries (Merritt et al., 2003). A younger till derived from the NW or N, commonly with a dark-coloured clay-rich matrix derived from Mesozoic mudstones of the Moray Firth basin is known from both Oldmill (where it overlies sands and gravels OSL dated to MIS 4) and Kirkhill/Leys where it is younger than the last interglacial palaeosols. At all these sites it underlies a till correlated with unit 5 at Savock. The matrix colour and texture of the unit 4 till at Savock resembles the MIS 6? till at Toddleshills, just 2.5 km to the north, and the weathered Rottenhill Till (MIS 6?) at Kirkhill quarry (Figure 1). To attempt to differentiate between these two possibilities samples for matrix palynology were collected from both tills at Savock and a thin section was recovered from the upper part of the lower diamicton to determine if there is evidence of pedogenesis, though no obvious pedogenic features were noted on site. Results from both analyses are awaited.
Figure 1. Location map of Buchan, NE Scotland, showing sites mentioned in the text and the surface distribution of major glacigenic lithostratigraphic subgroups.
Significance

Whilst critical information from palynology and thin section analysis are awaited it seems likely that the sequence recorded in Savock quarry may date back to the late Middle Pleistocene. Preliminary evidence suggests that the channel-fill gravels and sands (2 and 3 above) together with the Lower Diamicton (unit 4) may well date to MIS 6? If this proves to be correct Savock will extend the number of sites recording late Middle and Late Pleistocene events; a record of Pleistocene climate change unique onshore in Scotland. The site continues to be monitored and it is hoped to recover samples for lithological analysis and OSL dating of the sands within the basal channel-fill unit (unit 3 above) in due course.

Acknowledgements

I am most grateful to the QRA for a grant from the Quaternary Research Fund that supported the costs of the fieldwork. Professor Adrian Hall brought the site to my attention and the quarry operatives at the site were extremely helpful in allowing access and for providing information on the quarry. Thanks to Colin Turner for his very generous hospitality and to VABF for her support.

References


E. Rodger Connell
Department of Geography, Environment and Earth Sciences
University of Hull
Cottingham Road
Hull
HU6 7RX
rodger_connell@yahoo.co.uk
(R.Connell@hull.ac.uk)
THE EFFECT OF PERMAFROST DISTURBANCE ON HIGH-ARCTIC AQUATIC ECOSYSTEMS

Background and rationale

Arctic regions have experienced unprecedented recent environmental shifts, most evident in cryospheric decline and particularly permafrost degradation. Such permafrost deterioration can result in slope failures called active layer detachments that cause elevated sediment loading into the surrounding watershed, eventually washing into lakes (Vaughan, 2013). It is unclear how such degradation subsequently affects lake primary (diatom) productivity and species composition, and whether disturbance translates into the sedimentary record. Conditions at the Cape Bounty Arctic Watershed Observatory (CBAWO; Melville Island, Canada; 74°55’N, 109°35’W) are ideally suited to answer these questions because they have been monitored for over a decade, including baseline seasonal diatom assays of two lakes in 2003-2004 (Stewart and Lamoureux, 2012). The summer of 2007 was exceptionally warm at CBAWO (Lamoureux and Lafrenière, 2009), resulting in widespread permafrost degradation and elevated total dissolved solids loading that altered lake chemistry (Dugan et al., 2012). Furthermore, the disturbance created numerous persistent ponds available for colonization by pioneer diatom communities. Given the availability of comprehensive long term data on pre-disturbance diatoms and water quality for comparison, this project aims to test the hypothesis that physiochemical habitat perturbation drives ecological change.

Fieldwork

Fieldwork, partially funded by the QRA Quaternary Research Fund, was conducted in July-August 2014. Both lakes at CBAWO were sampled weekly for diatom habitats (lakebed/littoral sediments, rock scrapes, macrophytes; three replicates), plankton (plankton tows, sediment traps), and physicochemical analyses (mercury, methane, nutrients, chlorophyll-a, dissolved inorganic/organic carbon) and characteristics (electric conductivity, pH, temperature). Persistent ponds (n = 13) were sampled across disturbed and undisturbed sites for diatom analysis (three replicates: pond bed, rock scrapes, macrophytes; one plankton tow) and physicochemical analyses (as above). A total of 67 lake samples and 91 pond samples were collected for diatom assay, alongside physicochemical samples.

Preliminary results and significance

Physicochemical analyses of water samples are currently in progress, whereas samples for diatom (assemblage) analysis are being processed (following Stewart and Lamoureux, 2012). Preliminary, qualitative diatom results indicate diatoms
present throughout the littoral samples in both lakes. Small diatoms of the genera *Fragilaria* (*F. capucina*, *F. tenera*) are abundant, as are *Pinnularia* spp. and *Diadesmis* spp. These taxa have also been found in pre-disturbance diatom evaluations (Stewart and Lamoureux, 2012). Conversely, plankton samples collected in 2014 are not as rich in *Cyclotella* spp. Preliminary results for ponds indicate a surprisingly rich and abundant diatom flora at both undisturbed and disturbed sites. *Pinnularia* spp. and *Fragilaria* spp. are common, along with chain-forming *Staurosira* spp. and other organisms (e.g. *Daphnia* sp.).

Since permafrost degradation is projected to continue in future (Kirtman *et al.*, 2013), findings from this research will serve as important analogues for the effects of environmental disturbance on polar aquatic ecosystems. This research is also highly relevant to palaeolimnological studies. If diatom communities differ significantly between pre- and post-disturbance, this should become apparent in the sedimentary (microfossil) record, enabling the tracing of past disturbance events. Additionally, this research will give new insights into diatom colonization potential and patterns of newly available habitats.

**Acknowledgements**

A *QRA Quaternary Research Fund* awarded to AJP partially funded fieldwork for this project in the summer season 2014 (June-August). NSERC, ArcticNet NCE and Polar Continental Shelf Project grants awarded to SFL provided further funding. We are particularly grateful to Gill Ramsey, Elena Favaro, and Paul Treitz who provided invaluable assistance in the field.

**References**


Anna J. Pieńkowski
School of Ocean Sciences
Bangor University, Menai Bridge, LL59 5AB, UK
a.pienkowski@bangor.ac.uk

Present address: Department of Physical Sciences
MacEwan University, Edmonton, AB T5J 4S2, Canada
pienkowskia@macewan.ca

Scott F. Lamoureux
Department of Geography
Queen’s University, Kingston, ON K7L 3N6, Canada
scott.lamoureux@queensu.ca
REVIEW

DERBY (SHEET 125) ¹, AYLSHAM (SHEET 147) ²: BEDROCK AND SUPERFICIAL DEPOSITS EDITIONS (ENGLAND AND WALES).

GEOLOGY OF THE WELLINGTON DISTRICT:
SHEET EXPLANATION (311) 38PP ³

GEOLOGY OF THE NEWQUAY DISTRICT:
SHEET EXPLANATION (346) 42PP ⁴
R.G. CROFTS, E. HOUGH, A.J. HUMPAGE AND H.J. REEVES

FFOREST FAWR: EXPLORING THE LANDSCAPE OF A GLOBAL GEOPARK (PARTS OF SHEETS 212, 213, 230 AND 231) BEDROCK AND LANDSCAPE ⁵

Published by: British Geological Survey 2013 ⁵ 2014 ¹,²,³,⁴

ISBN 978 0 7518 3716 2 flat 978 0 7518 3715 5 folded and cased ¹
ISBN 978 0 7518 3780 3 flat 978 0 7518 3779 7 folded and cased ²
ISBN 978 085272587 0 ³
ISBN 978 085272752 2 ⁴
ISBN 978 0 7518 3787 2 flat 978 0 7518 3784 1 folded and cased ⁵

1:50,000 sheets £12 each, sheet explanations £9 each and £18 with accompanying map, Fforest Fawr map £6.95p; 25% discount for academic institutions when ordered from: Sales Desk, British Geological Survey, Keyworth, Nottingham NG12 5GG Tel: 0115 - 936 3241 Fax: 0115 - 936 3488 sales @bgs.ac.uk (prices exclude post and packing - in the UK a minimum of £2.50 and 10% of the original value of the goods up to maximum of £10).
Though the Derby sheet (125) has patchy superficial deposits nevertheless this is a key sheet in the English Midlands beyond the last Devensian glaciation containing remnants of older Anglian material. These older glacial tills are mainly undivided, and there are smaller patches of glaciofluvial deposits, and isolated glaciolacustrine deposits. While usually limited in extent there are river terrace deposits along the Trent and Derwent valleys which can often be subdivided into distinct members. In addition to alluvial deposits, there are patches of peat and head, consisting of soliflucuted near-surface material formed by repeated freezing and thawing of the ground. Furthermore significant landslides are marked, and cross-hatching shows the extent of modified ground associated with opencast coal mining. Though the margins contain a NEXTMap radar image of the area, the superimposed bedrock colours make it less informative than those used on other sheets, which are sharper and show much more fine detail. Unlike approximately a third of Britain, which for the foreseeable future will be left unrevised, this sheet was last resurveyed in the 1960s; and yet this coverage has been utterly overhauled, showing why this should have continued.

The Aylsham sheet (147) in Norfolk is mostly covered in glacial superficial deposits, though in the eastern half exposures of the underlying Wroxham Crag flank the river Bure and its tributaries. While this formation is Pleistocene in age, such marine deposits are classified as bedrock along with the underlying Chalk upon which it rests. This district’s Middle Pleistocene glacial history is highly complex with successive sequences truncating earlier ones. These consist of wholly or mainly Anglian till, glaciofluvial, diamicton, and locally chaotic assemblages. Though much of the district is riddled with small moraine ridges, these are not shown (Lee et al. 2013). In addition, gravels along the River Wensum, and later accumulations including alluvium and colluvium, are shown along with areas of modified ground. While there are notes outlining the local geology, these have no references and are in very small print in columns out of sync with the folding, as unlike the Derby sheet it is printed on a standard paper size. So while there are a couple of excellent schematic cross-sections and a table comparing the lithostratigraphy on adjacent sheets, the colour-shaded topographic relief map is reproduced at a much smaller scale. Furthermore, while a new regional memoir covering East Anglia is well in hand, this will do nothing for the dated coverage on the adjacent Norwich sheet (161), nor the region’s completely outmoded provisional editions based on patched up Victorian mapping.

Five years after the Wellington sheet (311) was published an accompanying sheet explanation has appeared. Though much of the district spanning Somerset and Devon in SW England is mantled with clay-with-flints, resting on the Chalk, the most notable superficial deposits are extensive spreads of head and colluvium and related landslips in the valleys and along the Blackdown Hills escarpment. Thus six pages are devoted to them, including a very clear map of the two main glacial limits in Britain north of this area, as the bedrock was exposed to
considerable periglacial action: not that Sir Simon Jenkins was aware of this in his book England’s 100 Best Views, when for example on page 89 he wrote about neighbouring Dorset: “At Lulworth a glacial stream must once have rolled down the hill and punched a hole in the limestone to reach the sea.” This is why such publications are needed, when a former chairman of the National Trust, which protects so much landscape, can display such utter ignorance. So, while much of this account is a bit dull, along with notes about superficial structures and local ground conditions, it provides a key reference for planning and land management. However, given that the introduction erroneously states that the end of the Pleistocene was 10 ka, it is hard to know if this holds for later warm and wet periods associated with landslipping, as cal. yr BP or preferably BM should have been used, along with a brief note about the radiocarbon dating.

While the Newquay (346) sheet explanation, accompanying the 50k map (Quaternary Newsletter No. 130, 70-73), concentrates on the Devonian rocks and igneous intrusions related to later mineralization and historic metalliferous mining, it includes over four pages on the Cenozoic, as some of these features are significant. The St Agnes formation deposited during the Oligocene to Miocene provides isolated evidence about early landscape evolution. However, the St Erth formation is briefly mentioned: having been dated to between 2·1 and 1·9 Ma, it is misattributed to the Late Pliocene, which throws into doubt the supposed Miocene age of a wave-cut platform just south of Porth covered by blown sand. Oddly, no mention is made of the close proximity of ice to the Cornish coast and changes in sea-level during successive glaciations. This postulated limit could have been included in a map locating these older features, though precise grid references are used to pin down places, including varied examples of ‘head’ deposits, first used by De la Beche (1839) who mapped the area to describe this periglacially weathered regolith. Further notes detail beach deposits, along with blown sand and alluvium.

Finally, the BGS have produced an innovative landscape map of the Fforest Fawr Geopark covering the western half of the Brecon Beacons in Wales. This simplified bedrock geology, stripped of mainly patchy glacial deposits, nevertheless clearly shows how the topography was moulded by glaciation influenced by this including the pattern of faulting. This is enhanced by a vertically exaggerated 3D perspective view pulled apart block diagram with two cross sections of the area. So while the superficial deposits have been relegated to a 100k insert map, they are also draped on this informative NEXTMap digital terrain model next to a clear and concise paragraph summarizing the Quaternary geology including key words in bold, with like the other blocks of text a Welsh translation in green and bilingual key to these units. In places the existing 50k superficial mapping appears to have been amended, as faults have been added and realigned along the northern margins of the clearly outdated Ammanford (230) and Merthyr Tydfil (231) sheets. So while this is an excellent publication, quite what Sir Henry De
la Beche, the first director of the Geological Survey, would have thought about the abandonment of systematic revision of the standard 50k series is a mystery, especially as the production of this map was funded with a tiny fraction of the Aggregate Levy on quarrying. Funds should have been readily available if Whitehall considered it was of strategic national interest - unlike Cardiff where the devolved government helped fund the mapping of areas untouched since Victorian times, including Mid Wales.

References


David Nowell
2 Tudor Road
New Barnet
Herts. EN5 5PA
zenadsl5483@zen.co.uk
ABSTRACTS

QRA DISSERTATION PRIZE 2014

PALAEOECOLOGICAL EVIDENCE FOR VEGETATION CHANGE AND FLUCTUATIONS IN THE WESTERLIES DURING THE HOLOCENE, LAGO BLANCO, TIERRA DEL FUEGO.

A record of environmental change in Tierra del Fuego (TDF) was reconstructed from a sediment core taken from a high altitude site near Lago Blanco. By employing pollen analysis, changes in vegetation communities were interpreted in order to address three key aims. The first of these aims was to establish whether Nothofagus (southern Beech) colonised TDF from glacial refugia sites. Secondly, to constrain the timing and nature of the changes in the South Westerly Winds (SSWs) in order to ascribe these regional climatic changes to their underlying driving mechanisms. The final aim was to investigate potential late-Holocene climatic perturbations in TDF as existing evidence for this period is inconsistent.

The results indicate that c.8,850 calendar years before present (Cal yr BP) there was an open and well established southern Beech forest around Lago Blanco, suggesting that Nothofagus forest colonisation occurred more quickly than expected, as a likely result of a westerly spread from easterly refugia sites. Moisture increases in western TDF c.9,200 Cal yr BP potentially mark a northwards latitudinal migration from below TDF, to near its present day position between 49° and 53°S. However, between 9,200 and 6,500 Cal yr BP shifts between more closed and more open Nothofagus forest suggest continued variability in SSWs, perhaps as a result of changes in the temperature gradients between the sub-tropical high and Antarctic low. The vegetation record shows forest stability between c.5,250 Cal yr BP and the present, although fluctuating loss on ignition values after c.4,200 Cal yr BP may be related to periodical cycles of precipitation increases in the late-Holocene. This study furthers our understanding of Fuego-Patagonian vegetation dynamics during the Holocene whilst providing a potential analogue for a future globally warmed (a rise of ~2°C) world with associated changes in the Southern Hemisphere temperature gradients.

Jonathan Kitchen
1 Ballengeich Road
Stirling FK8 1TN
jkitchen2@hotmail.co.uk
NEW RESEARCH WORKERS’ AWARD
MSC THESIS ABSTRACT

APPLICATION OF “ANNUAL” MORAINES TO ASSESS RECENT PATTERNS AND RATES OF ICE-MARGINAL RETREAT AT SKÁLAFELLSJÖKULL, SE ICELAND

Iceland is situated in a climatically sensitive area close to both atmospheric and oceanic polar fronts, thus representing an important location for understanding North Atlantic climatic change. Icelandic glaciers are particularly sensitive to climatic fluctuations on annual to decadal timescales, and have exhibited accelerating rates of ice-marginal retreat and mass loss during the past decade. Understanding these current rapid glacier fluctuations is crucial to placing current atmospheric warming and associated glacier retreat in a broader context.

This study uses the characteristics of recessional (“annual”) moraines and complementary climate data to examine patterns, rates and drivers of ice-marginal retreat at Skálafellsjökull, SE Iceland, since the 1930s. High-resolution glacial geomorphological mapping reveals suites of small-scale (<2 m in height) moraines across the glacier foreland, with the features displaying distinctive sawtooth planform geometries. Chronological investigations of the Skálafellsjökull moraines, which integrate remote sensing observations and lichenometry, indicate that small-scale moraines on the northern and central parts of the glacier foreland formed on an annual basis. Sedimentological investigations reveal that these annual moraines form through a range of ice-marginal processes, with combined push/squeeze mechanisms being dominant. The geomorphological, chronological and sedimentological data therefore indicate these moraines represent successive annual ice-frontal positions. Thus, the annual moraines provide a framework for exploring patterns, rates and drivers of ice-marginal retreat at Skálafellsjökull.

Annual ice-margin retreat rates (IMRRs), equivalent to annual moraine spacing, indicate prominent periods of glacier recession at Skálafellsjökull are coincident with those at other Icelandic outlet glaciers, as well as those identified at outlet glaciers in SE Greenland. Analysis of IMRRs and climate data suggests that fluctuations in summer air temperature, sea surface temperature (SST) and the North Atlantic Oscillation have an influence on IMRRs at Skálafellsjökull, with the glacier appearing to be most sensitive to summer air temperature variations. Additional analysis of the climate data demonstrates that there is a strong relationship between air temperature and SST variations on an inter-annual timescale. Based on this analysis, it is hypothesised that SST variations may drive air temperature change in the North Atlantic region, which in turn forces IMRRs. The increase in SSTs...
over recent decades may link to atmospheric-driven variations in North Atlantic
subpolar gyre dynamics. Further research on glacier change in the North Atlantic
region, and the controls thereon, is nonetheless required to test this hypothesis.

**Keywords:** “Annual” moraines; glacial geomorphology; sedimentology;
lichenometry; glacier-climate interactions; Iceland.

Benjamin M.P. Chandler
Department of Geography
Durham University

*Current address:*
School of Geography
Queen Mary University of London
Mile End Road
London, E1 4NS
b.m.p.chandler@qmul.ac.uk
QUATERNARY RESEARCH ASSOCIATION

The Quaternary Research Association is an organisation comprising archaeologists, botanists, civil engineers, geographers, geologists, soil scientists, zoologists and others interested in research into the problems of the Quaternary. The majority of members reside in Great Britain, but membership also extends to most European countries, North America, Africa, Asia and Australasia. Membership (currently c. 1,200) is open to all interested in the objectives of the Association. The annual subscription is £20 with reduced rates (£10) for students and unwaged members and an Institutional rate of £35.

The main meetings of the Association are the Field Meetings, usually lasting 3–4 days, in April, May and/or September, a 2–3 day Discussion Meeting at the beginning of January. Short Study Courses on techniques used in Quaternary work are also occasionally held. The publications of the Association are the Quaternary Newsletter issued in February, June and October; the Journal of Quaternary Science published in association with Wiley; and the QRA Field Guide and Technical Guide Series.

The Association is run by an Executive Committee elected at an Annual General Meeting held during the Annual Discussion Meeting in January. Current officers of the Association are:

**President:** Professor P. Coxon, Department of Geography, Museum Building, Trinity College, Dublin 2, Ireland (email: pcoxon@tcd.ie)

**Vice-President:** Professor D. Schreve, Department of Geography, Royal Holloway, University of London, Egham, Surrey, TW20 0EX (e-mail: Danielle.Schreve@rhul.ac.uk.)

**Secretary:** Dr M. Frogley, Department of Geography, Chichester 1, University of Sussex, Falmer, Brighton, BN1 9QJ (e-mail: m.r.frogley@sussex.ac.uk)

**Publications Secretary:** Dr J. Lee, British Geological Survey, Keyworth, Nottingham NG12 5GG (e-mail: jrlee@bgs.ac.uk)

**Treasurer:** Dr T. White, 59 Beechwood Avenue, Melbourn, Cambridgeshire SG8 6BW (e-mail: tom.white@rlaha.ox.ac.uk)

**Editor, Quaternary Newsletter:** Dr S. Lukas, School of Geography, Queen Mary University of London, Mile End Road, London, E1 4NS (e-mail: s.lukas@qmul.ac.uk)

**Editor, Journal of Quaternary Science:** Professor Geoff Duller, Institute of Geography and Earth Sciences, Aberystwyth University, Aberystwyth SW23 3DB (e-mail:editor@qra.org.uk)

**Publicity Officer:** Dr Bethan Davies, Department of Geography, Royal Holloway University of London, Egham Hill, Egham TW20 0EX (email: bethan.davies@rhul.ac.uk)

All questions regarding membership are dealt with by the Secretary, the Association’s publications are sold by the Publications Secretary and all subscription matters are dealt with by the Treasurer.

The QRA home age on the world wide web can be found at: http://www.qra.org.uk

Registered Charity: 262124
# JUNE 2015 No. 136

## Contents

<table>
<thead>
<tr>
<th>Page</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>OBITUARY</strong></td>
</tr>
<tr>
<td>1</td>
<td>Jocelyn Mary Riley (née Letzer) <em>Jim Rose</em></td>
</tr>
<tr>
<td>3</td>
<td><strong>ARTICLE</strong></td>
</tr>
<tr>
<td>3</td>
<td>A note on John Gough, 1757 - 1825: a pioneer scientist of lake and bog development <em>Keith E. Barber</em></td>
</tr>
<tr>
<td>8</td>
<td><strong>REPORTS</strong></td>
</tr>
<tr>
<td>8</td>
<td>QRA Annual International Postgraduate Symposium, 27-29 August 2014, University of Exeter</td>
</tr>
<tr>
<td>18</td>
<td><strong>NEW RESEARCHERS AWARD SCHEME</strong></td>
</tr>
<tr>
<td>18</td>
<td>Increasing freshwater runoff and tidal action influences on spatial mixing patterns in Søndre Strømfjord, West Greenland</td>
</tr>
<tr>
<td>22</td>
<td><strong>QUATERNARY RESEARCHER FUND</strong></td>
</tr>
<tr>
<td>22</td>
<td>The Pleistocene sediments at Savock Quarry, Buchan, NE Scotland <em>E. Rodger Connell</em></td>
</tr>
<tr>
<td>26</td>
<td>The effect of permafrost disturbance on high-arctic aquatic ecosystems <em>Anna J. Pienkowski and Scott F. Lamoureux</em></td>
</tr>
<tr>
<td>29</td>
<td><strong>REVIEW</strong></td>
</tr>
<tr>
<td>29</td>
<td>Recent BGS sheets and sheet explanation <em>David Nowell</em></td>
</tr>
<tr>
<td>32</td>
<td><strong>ABSTRACTS</strong></td>
</tr>
<tr>
<td>32</td>
<td>QRA Undergraduate Dissertation Prize Winner <em>Jonathan Kitchen</em></td>
</tr>
<tr>
<td>34</td>
<td>MSc abstract (former NRW Award holder) <em>Benjamin M.P. Chandler</em></td>
</tr>
</tbody>
</table>

**ISSN 0 143-2826**